

The Afrotropical Species of *Leptomastidea* Mercet (Hymenoptera: Encyrtidae), Parasitoids of Mealybugs

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Abstract.—The Afrotropical mealybug parasitoids of the genus *Leptomastidea* Mercet (Encyrtidae) are revised and the following six species described as new: *ascia*, *lamto*, *pondo*, *tecta*, *turba* and *usta*. Diagnoses are provided for *L. abnormis* (Girault) and *L. jeanneli* Mercet, revised status, in addition to a key for the separation of females of the eight species of the genus known from the region.

Leptomastidea Mercet is an Old World genus, the species of which are all primary endoparasitoids of mealybugs (Homoptera: Pseudococcidae). The genus is particularly well known through *L. abnormis* (Girault), which has been used extensively in the biological control of the citrus mealybug, *Planococcus citri* (Risso), in several parts of the world, including countries in North and South America and Africa as well as Australia (Noyes and Hayat 1994). Undoubtedly, species of *Leptomastidea* also play a role in regulating mealybug populations in their native environment, as in the case of *L. usta* sp. nov., an indigenous species that is part of the complex of hymenopterous parasitoids associated with citrus mealybugs in certain areas of South Africa.

Apart from the six new species described below, *Leptomastidea* is known from 18 species worldwide, the majority of which are found in the Palaearctic and Oriental regions. A key to the Palaearctic species is provided by Trjapitzin (1989) and a detailed account of the Oriental fauna is given by Noyes and Hayat (1994). The Afrotropical fauna has not been studied in any detail before and was hitherto known from only four species: *L. abnormis* (Girault), *L. jeanneli* Mercet, *L. seyrigi* Ris-

bec and *L. ambositrensis* Risbec, the latter two species having since been transferred by Noyes and Hayat (1994) to *Homalotylus* Mayr and *Rhitidithorax* Ashmead respectively. *Leptomastidea jeanneli* was synonymized with *L. abnormis* by Noyes (2000) but is treated here as a valid species.

In addition to numerous specimens collected by sweeping and Malaise traps in West, East and southern Africa, the present study is based mainly on reared South African material. There are at least three apparently undescribed species among the material that have been excluded from this study because of the paucity of specimens, whereas the specific identity of several other specimens could not be determined with certainty. In view of the difficulties encountered during this study in interpreting the nature of certain variation it is felt that the identity of these specimens is best left in abeyance until additional material, especially host-reared series, become available.

The following acronyms are used in the text: BMNH (The Natural History Museum, London); MNCN (Museo Nacional de Ciencias Naturales, Madrid); NMK (National Museum of Kenya, Nairobi); SANC (South African National Collection of Insects, Plant Protection Research Institute, Pretoria).

Leptomastidea Mercet

Leptomastidea Mercet 1916: 112. Type species *Leptomastidea aurantiaca* Mercet, by monotypy.

Tanaomastix Timberlake 1918: 362. Type-species *Paraleptomastix abnormis* Girault, by original designation.

A detailed account of the taxonomic status of *Leptomastidea*, including a diagnosis and key for separating it from other genera of the tribe Anagyrini, is provided by Noyes and Hayat (1994) and need not be repeated here. Suffice it to mention that *Leptomastidea* is most closely allied to *Gyrauusoidea* Compere, the eight Afrotropical species of which were treated by Prinsloo (1983). Noyes and Hayat (1994) state that, pending a phylogenetic analysis of the Anagyrini, these two genera may eventually be considered synonymous. Judging by the extent to which certain characters overlap between these genera in some extra-limital species there may be justification for such a step. However, as far as the Afrotropical fauna is concerned, the two genera can be readily delineated and I therefore agree with Noyes and Hayat (1994) that they should, at least for the time being, be treated separately.

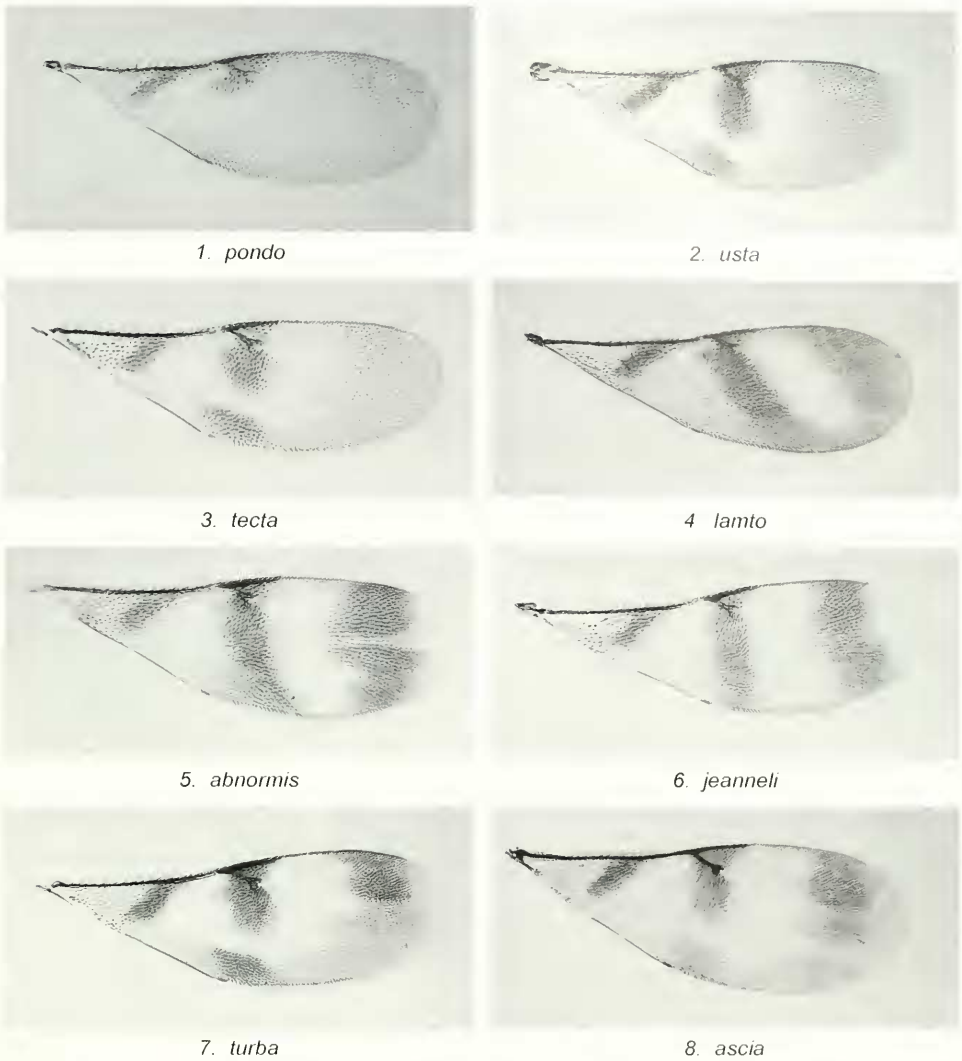
Some of the Afrotropical species treated here are structurally very similar, especially in taxonomically important characters such as the shape and relative dimensions of the head, antenna, thorax, forewing venation and ovipositor, and in the setation and sculpture of the body. On the

other hand, these species differ markedly in the maculation of the forewing, the arrangement of fine and coarse setae on the wing disc and, in most cases, colour pattern of the body. The question is whether these differences merely represent infraspecific variation and whether those forms that are otherwise morphologically very similar should therefore be treated as geographical races (subspecies) or variants of the same species rather than distinct species. This is especially so in the case of *L. abnormis* (Girault) and *L. jeanneli* Mercet, and in the closely allied *L. truba* sp. nov. and *L. usta* sp. nov.

The likelihood of these differences being of an infraspecies nature has, however, been precluded here. In this regard wing maculation and setation in particular were found to be stable differentiating characters, both within populations and between geographically widely separated populations, with no evidence of any clinal or gradual variation being present. This, coupled to the fact that the forms in question are evidently sympatric, renders it unlikely that they are mere variants or races of the same species, and they are consequently regarded as representing distinct species. This does not imply that all observed differences in colour and wing maculation have been interpreted as being of an interspecific nature since infraspecific variation, usually in the form of colour differences within populations, is evidently also present, as is commonly found in various taxa of the Anagyrini.

KEY TO AFROTROPICAL SPECIES OF *LEPTOMASTIDEA* (based on females)

1. Forewing hyaline except for an oblique dark cross-band below submarginal vein and a dark patch at apex of venation; forewing setation uniform, not forming areas of fine and coarse setae (Fig. 1); hind coxa white 8. *pondo* sp. nov.
- Forewing maculation different; forewing setation comprising areas of fine and coarse setae (Figs. 2–8); hind coxa brown to blackish-brown 2
2. Forewing with a dark cross-band below submarginal vein and a second, broadly interrupted band below apex of venation, disc beyond venation hyaline but may appear slightly



Figs.1-8. *Leptomastidea* spp., female (paratypes except in *abnormis* and *jeanneli*), forewing, showing maculation.

- darkened in part because of the presence of coarse dark setae (Figs. 2, 3); mesopleuron orange to red 3
- Forewing maculation different, wing disc beyond venation partly infuscated (Figs. 4-8); mesopleuron always whitish, or pale with dusky suffusions 4
- 3. Gena boldly marked with blackish-brown; ovipositor about as long as middle tibia (Fig. 17) 4 *tecta* sp. nov.
- Gena white to yellowish without dark markings; ovipositor about half as long as middle tibia (Fig. 13) 3 *usta* sp. nov.
- 4. Apical half of forewing fuscous with a large, oblique hyaline area extending from anterior wing margin to near posterior margin as in Fig. 4, extreme apex of wing disc hyaline in some specimens; ovipositor about one-third as long as middle tibia (Fig. 20) 7 *lamto* sp. nov.
- Apical half of forewing with maculation different (Figs. 5-8); ovipositor about half as long as middle tibia. 5

5. Forewing with dark cross-band below apex of venation broadly interrupted near posterior wing margin as in Figs. 7, 8 6
 - Cross-band below apex of forewing venation complete or narrowly interrupted (Figs. 5, 6) 7
6. Thoracic dorsum dark yellow to orange, gaster white basally, blackish apically; forewing about 3.0-3.3 X as long as broad, disc beyond venation hyaline with a large subapical dark patch at anterior wing margin as in Fig. 7 5. *turba* sp. nov.
 - Thoracic dorsum and gaster entirely blackish-brown to black; forewing broader, less than 3 X times as long as wide, disc beyond venation with an interrupted subapical cross-band band as in Fig. 8 6. *ascia* sp. nov.
7. Forewing with dark cross-band below apex of venation at right angles to anterior wing margin, parallel-sided; sub-apical cross-band entire, not interrupted in middle (Figs. 6, 9) 2. *jeanneli* Mercet
 - Cross-band below apex of venation not parallel-sided but broadening towards posterior wing margin; sub-apical cross-band interrupted in middle by a hyaline streak (Fig.5) 1. *abnormis* (Girault)

1. *Leptomastidea abnormis* (Girault)
 (Fig. 5)

Paraleptomastix abnormis Girault 1915: 184.

Tanaomastix abnormis (Girault): Timberlake 1918: 364.

Leptomastidea abnormis (Girault): Mercet 1924: 255-256.

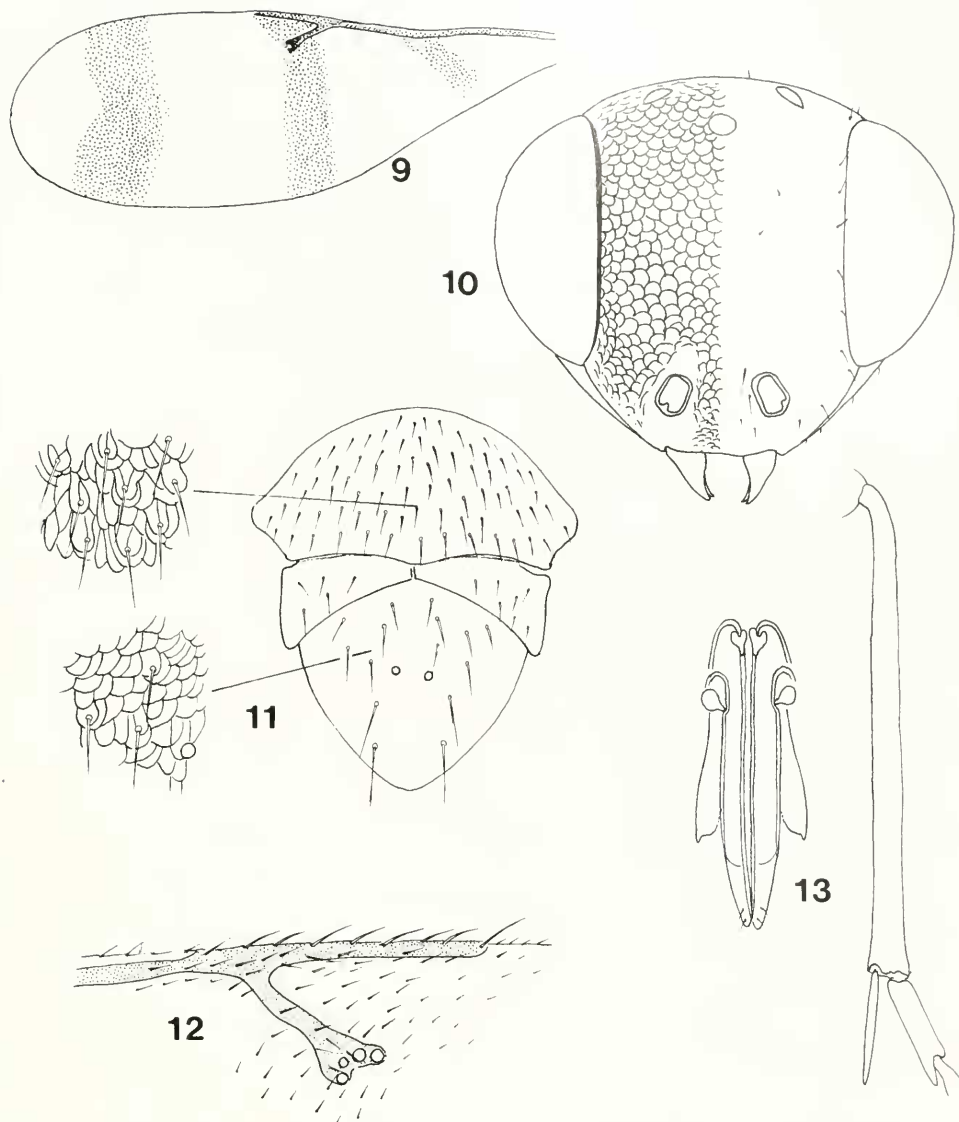
Leptomastidea aurantiaca Mercet 1916: 113-116; Mercet 1924: 255 (synonymy).

Diagnosis.—*Female.* Head yellowish with face, temple and gena whitish in most specimens; antenna with radicle dark brown; scape white below, upper sides and dorsal aspect dark brown; pedicel with basal half dark brown, apical half white; flagellum brownish with basal two funicle segments and club usually darker than remaining segments. Thoracic dorsum yellowish with mesonotum strongly suffused with dark brown; propodeum dark brown; side of thorax largely whitish. Forewing with three dark cross-bands as in Fig. 5, intermediate one oblique, broadening towards posterior wing margin; both intermediate and sub-apical bands narrowly interrupted, former near posterior wing margin, latter in middle; sub-apical band distinctly broader than hyaline area separating it from apical wing margin. Legs whitish with middle and hind coxae brown and dorsal margin

of all femora darkly outlined; basal half of gaster whitish, apical half strongly suffused with dark brown.

Male.—*Colour:* much as in female except: legs entirely white, middle and hind coxae not dark; sub-apical cross-band on forewing faint, usually indistinct; gaster more extensively darkened.

Material examined.—KENYA: Sabukia, xi. 1931, H.C. James, ex *Pseudococcus citri* (= prob. *Planococcus kenyae* (Le Pelley)) on *Coffea arabica* (1 male, det. C. Ferrière). SENEGAL: locality unknown, v.1981, J. Etienne, ex *Ferrisia virgata* (Cockerell) (2 females, 2 males; T 6324). SOUTH AFRICA: Western Cape Province: Paarl, i.1975, G.L. Prinsloo, ex *Planococcus ficus* (Signoret) on grapes (3 females, 1 male; T 5153); Citrusdal, vi.1971, F. Honiball, ex *Planococcus citri* on citrus (2 females, 2 males; T 3854); same data except v.1971 (2 females, 2 males; T3808); Northern Province: Zebediela, vi.1966, H. Baas, ex mealybugs on citrus (3 females, 1 male; T 2342); Mpumalanga Province: Nelspruit, v.1972, H.P. Insley, with scale insects on *Maytemis* sp. (1 female, 1 male; T 4353); North West Province: Rustenburg, xi.1971, C.J. Cilliers, ex mealybugs on citrus (3 females, 1 male; T 4014); same data except i.1972 (5 females, 1 male; T 7110); Gauteng Province:



Figs. 9–13. *Leptomastidea* spp., females. 9, *L. jeanneli*, lectotype, forewing, showing maculation. 10–13, *L. usta*, paratypes. 10, Head, frontal view. 11, Mesonotum with sculpture of mesoscutum and scutellum enlarged. 12, Apex of forewing venation. 13, Ovipositor and middle tibia drawn to the same scale.

Pretoria, vi.1965, S.W. Broodryk, host unknown (1 female, 1 male; T 1980). UGANDA: Kiki, vii.1971, K. Ogwaro, with scale insects on citrus (1 female; T3912). All specimens in SANC.

Extra-limital Material.—AUSTRALIA: Palmwoods, Queensland, iii.1978, D. Murray, ex *Planococcus citri* on custard apple (6 females; T 5269). ISRAEL: Neot Haki-

kar, xi.1980, Y. Ben-Dov, with scale insects on *Phoenix dactylifera* (2 females, 1 male; T6232). USA: "Whittier, Calif. 1922, Rust, ex *Pseudococcus citri*" (10 females, 10 males; T 4274). All specimens in SANC.

Remarks.—This well known economically important species was originally described from Sicily and subsequently introduced to various parts of the world (in

many cases via laboratory stocks obtained from California) for the control of *Planococcus citri* and other mealybug species. A summary of the literature pertaining to the use of *L. abnormis* in biological control worldwide is provided by Noyes and Hayat (1994).

Within the African context, *L. abnormis* was imported into South Africa between 1934 and 1940 for the control of *Planococcus ficus* (thought to be *P. citri*) on grapes in the Western Cape Province where it became established. It was never deliberately released against *P. citri* on citrus but is now found in association with this pest throughout the citrus-growing areas of the country. Other introductions into Africa, which took place during the first half of the previous century and regarded as having been unsuccessful (see Noyes and Hayat 1994), were to Ghana and Kenya for the control of *Planococcoides njalensis* (Laing) and *Planococcus kenyae* respectively.

Leptomastidea abnormis has repeatedly been redescribed and illustrated in the literature, with recent accounts by Noyes (1988, 2000). Suffice it to mention that this species can be distinguished from its African congeners by the foregoing diagnosis and key. Its relationship with *L. jeanneli* Mercet, with which it was synonymized by Noyes (2000), is discussed in the treatment of the latter species below.

2. *Leptomastidea jeanneli* Mercet, revised status (Figs. 6, 9)

Leptomastidea jeanneli Mercet 1924: 256–258;
Compere 1939: 25; Noyes 2000: 138 [as a junior synonym of *L. abnormis* (Girault)].

Redescription.—*Card-mounted female lectotype.* Length: 1.0 mm. *Colour:* Head entirely whitish, obviously faded; antenna uniformly blackish-brown except apical one-third or so of pedicel white. Thorax, propodeum and gaster blackish-brown except mesopleuron and prepectus whitish,

tegula white basally, darkly suffused apically. Forewing with three dark cross-bands as in Fig. 9, intermediate one at right angles to anterior wing margin, relatively narrow, parallel-sided, not somewhat oblique and broader towards posterior wing margin as in *L. abnormis*; intermediate and sub-apical bands not interrupted; sub-apical band subequal in width to hyaline area separating it from apical wing margin. Legs with fore coxa whitish, middle and hind coxae blackish-brown; legs otherwise whitish with hind femur entirely blackish-brown and fore and middle femora darkly outlined dorsally. *Head:* in dorsal view, twice as wide as frontovertex at median ocellus; ocelli in a right-angled triangle, lateral pair about twice own diameter from eye margins; head otherwise typical of genus, inner eye margins approximately parallel-sided, frontovertex with regular, raised reticulate sculpture; eyes appearing naked. Antenna with scape subcylindrical, about 5.5× as long as wide; pedicel as long as basal funicle segment; funicle segments subequal in length, basal one 3.5× as long as wide, remaining segments becoming progressively very slightly broader; club slightly longer than distal two funicle segments combined; linear sensillae discernible on funicle segment VI and club. Forewing 2.9× as long as wide; costal cell hardly discernible; basal triangle of wing disc densely and fairly coarsely setose except for a narrow bare streak below basal third of submarginal vein, this streak separated from submarginal vein by a single row of setae; areas of wing disc delineated by fuscous cross-bands with dark, fairly coarse setae, setae covering hyaline areas fine and pale, hardly visible under low magnification; postmarginal vein approximately 3× as long as marginal, a little less than twice as long as stigmal vein. Middle leg with tibial spur a little shorter than basal tarsal segment. General shape of thorax and gaster similar to *A. abnormis* and many other species of the genus,

sculpture and setation of thorax not clearly discernible in the card-mounted specimen, but appearing similar to that of the latter species.

Variation.—Female. At hand are a number of specimens from Zimbabwe, Kenya and various countries in West Africa which differ in colour from the female lectotype as follows: antenna with scape and flagellum not uniformly dark but scape bicolorous, whitish below, upper sides and dorsum blackish-brown, funicle entirely pale brown or with basal two or three segments distinctly darker, club blackish-brown; thoracic dorsum dominantly yellowish-brown; basal half or so of gaster white, apical half blackish-brown; legs, save dark middle and hind coxae, entirely whitish. Also available is a single additional specimen from Zimbabwe which, unlike these specimens, differs from the lectotype only in the paler thoracic dorsum and bicolorous antennal scape.

Type material examined.—Female lectotype (MNCN), designated by J.S. Noyes, with following data: “Naivasha, Africa or. Inglesa; *Leptomastidea jeanneli* Mercet, tipo; MNCN Cat. Tipo No. 10434”.

Additional material.—GHANA: Tafo, iv and v. 1973, M. Bigger, ex *Planocoides njalensis* (9 females BMNH). KENYA: “Don-yo, Sabuk, 1939, C 127, A.R. Melville, ex *Pseudococcus* sp. on *Combretum*, B.M. 1839–601, *Leptomastidea jeanneli* Mercet, det. Ferrière” (4 females; T 6621; SANC). NIGERIA: Ibadan, IIT Compound, xi.1987, J.S. Noyes (19 females; BMNH). TOGO: 5 km. W Amiame, 16.xii.1988, J.S. Noyes (1 female; BMNH). SÃO TOMÉ: xii.1974, J.O. Derron, ex *Planocoides njalensis* on cacao (1 female; T 4943; SANC). ZIMBABWE: Harare (= Rhodesia: Salisbury), xi.1974, ix.1976, ix.1979, iii.1984, A. Watsham (4 females; BMNH).

Remarks.—This species was originally described from an undisclosed number of female specimens from Naivasha, which is in Kenya, not Uganda as cited by Mercet (1924). The only known type specimen, a

lectotype designated by Noyes (1981), is in good condition and mounted on a card.

Leptomastidea jeanneli was recently synonymized with *L. abnormis* by Noyes (2000) who mentioned that the characters listed by Mercet (1924) for separating these two species fall within the range of variation found in *L. abnormis*. Although these two species are indeed very similar, I am nevertheless of the opinion that *L. jeanneli* should be resurrected as a valid species. I base this decision on the distinct difference in the shape of the fuscous crossbands on the forewing, as described above and shown in Figs. 5, 6 and 9. I do not believe that this difference reflects infraspecific variation, especially in view of the fact that the characteristic wing pattern in *L. abnormis* is not known to vary significantly, as is evident from the large amount of available study material and many published accounts of this geographically widespread and experimentally well known species.

The difference in body colour between the female lectotype of *L. jeanneli* and the specimens mentioned under “Variation” is attributed to infraspecific variation on the basis of the intermediate colour pattern of the single specimen from Zimbabwe. In this specimen the gaster, legs, and antennal flagellum are characteristic of the lectotype, whereas the antennal scape is bicolorous as in the other specimens from Zimbabwe and those from West Africa and Kenya. I am also of the opinion that, as far as the noted variation in colour is concerned, both the lectotype and intermediate specimen from Zimbabwe represent aberrant forms of *L. jeanneli*, the “normal” form being represented by the remaining specimens. Interestingly, the series from Kenya was identified as *L. jeanneli* by the late Ch. Ferrière, lending further support to the present interpretation of the taxonomic identity of the study material.

Compere (1939) recorded this species from a short series of specimens from

Kenya and a single female from Eritrea, none of which, according to Compere, are in complete agreement with Mercet's description of *L. jeanneli*. I have not seen these specimens.

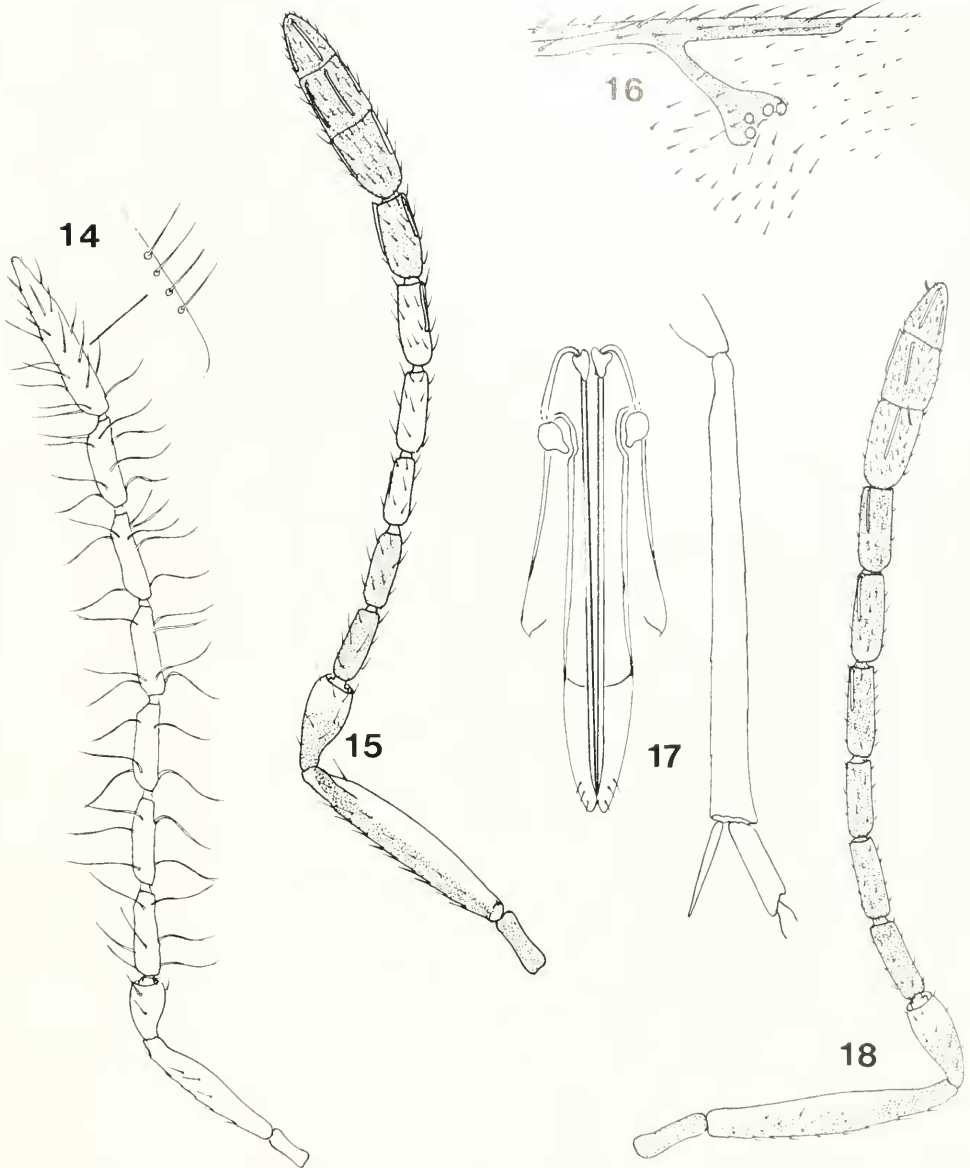
3. *Leptomastidea usta* Prinsloo, new species

(Figs. 2, 10–15)

Description.—*Female.* Length: 0.7–0.9 mm. *Colour:* Head, thorax and propodeum entirely reddish-orange to red except temple, gena, mouth margin and area between scrobes white to yellowish; tegula white to reddish basally, brown apically; setae on frontovertex and mesonotum white. Antenna with radicle blackish-brown; scape white below, upper sides, and dorsal aspect from base to near apex, blackish-brown; basal half of pedicel blackish-brown, apical half white; flagellum usually brown to blackish-brown except funicle segments III–V or III–VI white; flagellum rarely entirely dark. Forewing (Fig. 2) with two dark cross-bands, basal one (below submarginal vein) strongly oblique, distal one (at apex of venation) broadly interrupted, wing disc beyond venation hyaline but appearing slightly darkened in part because of the presence of coarse dark setae; hind wing entirely hyaline. Legs with fore coxa whitish, middle and hind coxae blackish-brown; legs otherwise mostly whitish with dorsal margins of all femora darkly outlined, middle and hind tibiae also somewhat darkened in some specimens. Gaster white with apical third unevenly suffused with brown to blackish-brown, base also dark in some specimens. *Head:* in dorsal view, 1.7–1.9× as wide as frontovertex at median ocellus; ocelli in a right-angled triangle, lateral pair separated from inner eye margins by about twice own diameter; in frontal view (Fig. 10), about 1.2× as wide as long, malar space 0.5× eye length; with regular more or less circular sculptural cells as illustrated, the diameter of cells on frontovertex about the same as that of eye facet;

front aspect of head, and eyes, sparsely and finely setose, eyes appearing naked under low magnification, setae shorter than diameter of eye facet. Antenna (Fig. 15) with scape subcylindrical, approximately 5× as long as wide; pedicel ranging from as long as to 1.3× as long as basal funicle segment; funicle segments subequal in size, basal segment 2.5–3.1× as long as wide; club as long as distal two and a half funicle segments combined; linear sensillae on all club and distal two or three funicle segments. *Thorax:* typical of genus, dimensions, sculpture and setation of mesonotum as in Fig. 11. Forewing (Fig. 2) 2.8–3.3× as long as wide; costal cell narrow, barely discernible in basal half in most specimens, with a single row of setae on ventral margin; venation (Fig. 12) with postmarginal vein 1.3–1.6× length of stigmal, 2.5–3.0× as long as marginal, latter 0.5–0.6× length of stigmal vein; setae in area between the two fuscous bands and in a large patch beyond venation paler and much finer than remaining discal setae. *Ovipositor* (Fig. 13): 0.5–0.6× length of middle tibia; gonostyli 0.5–0.7× length of middle tibial spur, latter subequal in length to basal tarsal segment of middle leg.

Male.—*Colour:* Head with frontovertex orange, fading to yellow on face and gena; antenna with scape whitish except dorsal aspect brown; remainder of antenna brown. Thorax, propodeum and gaster dominantly dark brown to blackish-brown with yellowish-brown suffusions on sides of mesonotum. Forewing with an oblique pale brown band below submarginal vein as in female and a faint dark patch at apex of venation that does not form a cross-band. Legs much as in female. *Structure:* Differing from female mainly as follows: torulus placed higher on face, its lower margin more or less level with lower eye margins. Antenna (Fig. 14) with scape about 4.5× as long as wide; funicle segments subequal in length, each about 4× as long as wide; club unseg-



Figs. 14–18. *Leptomastidea* spp. 14–15. *L. usta*, paratypes. 14, Antenna and sub-basal row of spine-like setae on club, male. 15, Antenna, female. 16–18. *L. tecta*, female paratype. 16, Apex of forewing venation. 17, Ovipositor and middle tibia drawn to the same scale. 18, Antenna.

mented, as long as distal two funicle segments combined; funicle with long, curved setae, each about 3× as long as the width of a segment; club, apart from normal setation, with a longitudinal row of 3–4 short straight setae ventrally near base (Fig. 14). Forewing slightly broader than

in female, about 2.5× as long as wide; wing disc uniformly setose, not differentiated into areas with fine and coarse setae as in female. Phallosome less than half as long as middle tibia; tigli each terminating in two short, stout hooklets.

Material examinca.—Female holotype, 29

female, 12 male paratypes as follows: BOTSWANA: Serowe, ix.1987, P. Forschhammer (1 female; BMNH). SOUTH AFRICA: Northern Province: Zebediela, vi-vii.1966, H. Baas, with *Nipacoccus viridis* (Newstead) and *Paracoccus buruerac* (Brain) on citrus (holotype, 5 females, 1 male; T 2343); Zebediela, vi.1981, M. van der Kooij, ex mealybugs on citrus (6 females, T 6307); Western Cape Province: De Doorns, 8.x.1968, V.B. Whitehead, ex mealybugs on *Elytropappus rhinocerotis* (L.f.) Less. (1 female, 6 males; T 2763); same data except H.P. Insley, 14.ii.1969 (1 female, 2 males; T 2976); Stellenbosch, ii.1969, H.P. Insley, ex mealybugs on *Stoebe vulgaris* Levyns (2 females; T2975); Stellenbosch, ix.1965, W.B. Whitehead, ex *Phenacoccus stelli* (Brain) on *Leucadendron daphnoides* (Thunb.) Meisn. (1 female; T 2019); Nature's Valley, iii.1970, H.P. Insley, ex mealybugs on *Metalasia muricata* (L.) D.Don (2 females; T 3407); Gauteng Province: Roodeplaat Dam, nr Pretoria, iii.1972, H.P. Insley, ex *Delottococcus quaesitus* (Brain) on *Acacia* sp. (2 females; T 4293); Kwazulu-Natal: Oribi Gorge, i.1972, H.P. Insley, ex mealybugs on *Cryptocarya weyliei* Stapf (4 females, 1 male; T 4191); Eastern Cape Province: Willowmore, i.1979, C. Kok, with *Tachardina* sp. on *Elytropappus rhinocerotis* (L. f) Less. (4 females, 2 males; T 7 111). ZIMBABWE: Harare (= Rhodesia; Salisbury), xi.1976, A. Watsham (1 female; BMNH). All specimens in SANC unless otherwise noted.

Remarks.—This widespread southern African species is readily separated in the female from its Afrotropical congeners, except *L. tecta*, by the striking reddish head and thorax and maculation of the forewing; it differs from *L. tecta* sp. nov. as mentioned in the treatment of that species below. *Leptomastidea usta* also resembles *L. rubra* Tachikawa, which is known from the Palaearctic region, closely in structure, body colour and general colour pattern of the forewing. The two species can, however, be distinguished by the

maculation of the forewing as follows: in *L. rubra* the infuscation at the apex of the venation forms a strongly oblique, incomplete band that extends about half-way across wing disc; in *L. usta* this band is almost at right angles to the anterior wing margin and, although broadly interrupted, extends across the entire width of the wing.

4. *Leptomastidea tecta* Prinsloo, new species

(Figs. 3, 16–18)

Description.—*Female.* Length: 0.7–0.8 mm. *Colour:* Head brownish-yellow to pale orange with temple white, gena boldly marked with blackish-brown, this colour extending upwards onto hind margin of temple; setae on front aspect of head whitish. Antenna with radicle blackish-brown; scape with dorsal aspect and upper half of sides blackish-brown, otherwise white; pedicel with basal two-thirds blackish-brown, fading to white distally; flagellum entirely and uniformly blackish-brown. Thorax and propodeum orange except prepectus and collar of pronotum whitish, anterior margin of mesoscutum (partly obscured by pronotum) darkly suffused; tegula whitish to orange basally, dusky distally; thoracic setation silvery-white. Forewing (Fig. 3) with an oblique dark band below submarginal vein and a second, broadly interrupted one at apex of venation, disc beyond venation hyaline, appearing partly somewhat darkened because of the presence of coarse dark setae; hind wing entirely hyaline. Fore coxa mostly whitish, middle and hind coxae brown; fore leg white with dorsal and ventral margins of femur darkly outlined, tibia slightly embrowned in one specimen; middle and hind legs whitish with dorsal margin of femora darkly outlined and hind tibia with dusky suffusions, distal one or two tarsal segments dark. Gaster white with apical one-third or so blackish-brown, extreme base also darkly suffused in some specimens. *Head:* 1.8× as wide as

frontovertex at median ocellus, dimensions, sculpture and setation much as described and illustrated for *L. usta*. Antenna (Fig. 18) with scape $5.5\times$ as long as broad; pedicel slightly longer than basal funicle segment; funicle segments subequal in length, basal segment $3.0\text{--}3.3\times$ as long as wide; club as long as distal two and a half funicle segments combined; flagellum finely and fairly sparsely setose as in Fig. 18; linear sensillae present on club and distal three funicle segments in two slide-mounted specimens. *Thorax*: sculpture and setation not significantly different from that of *L. usta*. Forewing as in Fig. 3, $3\times$ times as long as wide, arrangement of fine and coarse setae much as in *L. usta*; costal cell narrow but clearly discernible; venation (Fig. 16) with postmarginal vein $1.3\text{--}1.4\times$ as long as stigmal, about $3.2\times$ as long as marginal, latter $0.5\times$ length of stigmal. *Ovipositor* (Fig. 17): unusually long, about as long as gaster and equal in length to middle tibia, gonostyli $1.0\text{--}1.2\times$ as long as middle tibial spur.

Male.—*Colour*: Head with frontovertex dark yellow, fronto-occipital margin narrowly outlined in black; face and temple white, gena with a bold blackish-brown marking as in female. Antenna with scape bicolorous as in female, otherwise entirely brown. Thoracic dorsum dominantly blackish-brown except collar of pronotum white, side of mesoscutum and posterolateral margins of scutellum narrowly outlined in orange, metanotum orange; side of thorax with mesopleuron boldly marked with yellow or orange anteriorly, otherwise blackish-brown; prepectus white. Forewing hyaline with a pale brown oblique band below submarginal vein as in female and a large infuscated patch at apex of venation. Legs much as in female. Gaster entirely blackish. *Structure*: similar to male of *L. usta* except phallobase relatively longer, a little more than half as long as middle tibia.

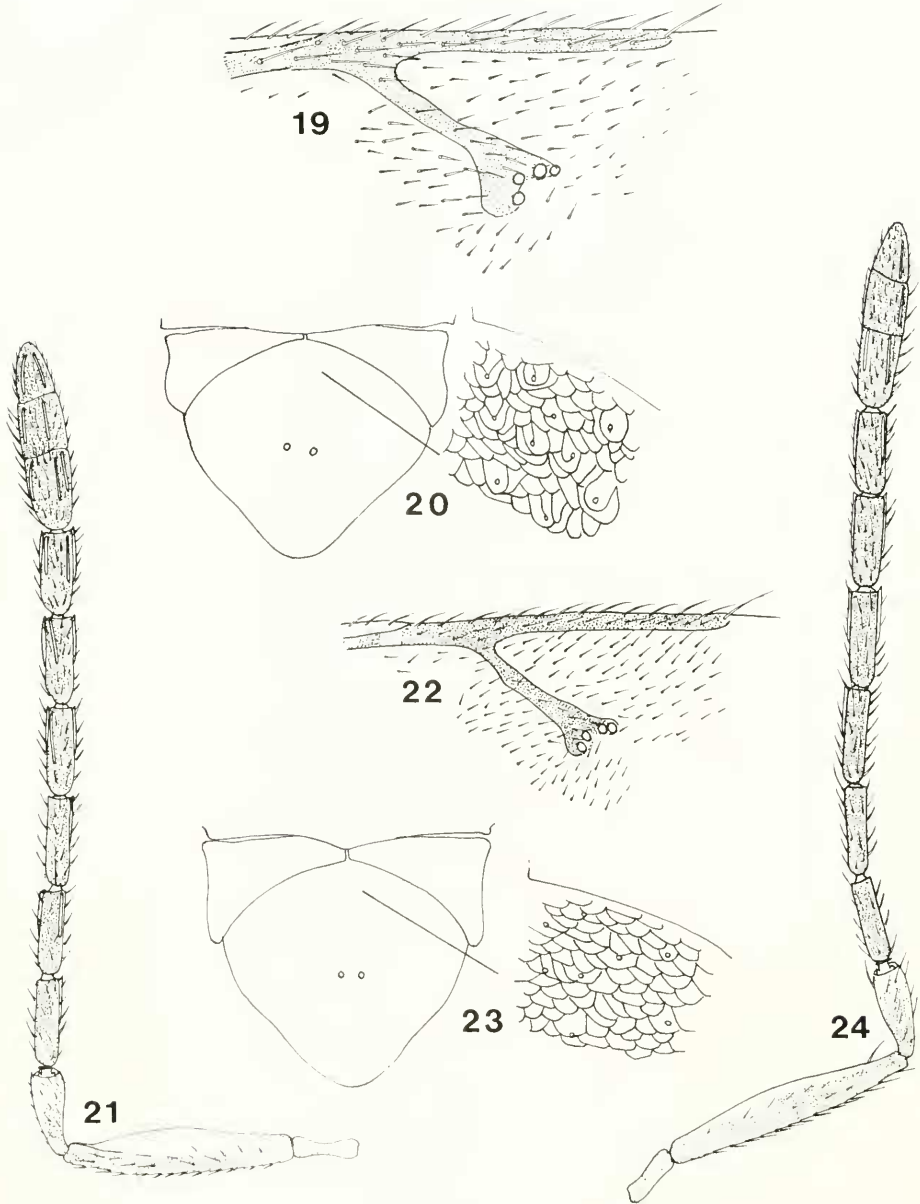
Material examined.—Female holotype, 3 female, 4 male paratypes (SANC) as fol-

lows: SOUTH AFRICA: Eastern Cape Province: Georgida, xi. 1983, G.L. Prinsloo, ex *Lenania* sp. on *Salsola glabrescens* Burt Davy (T 7112).

Remarks.—This species, which is known only from South Africa, can be separated in the female from all the other Afrotropical species by the unusually long ovipositor, whereas the forewing maculation is unlike that of any of the extra-limital species. *Leptomastidea tecta* resembles *L. usta* closely in structure, colour and, perhaps most significantly, maculation and setation of the forewing. It differs from the latter species in the genae which are boldly marked with blackish-brown, the dimensions of the antennal segments, and ovipositor which is as long as the middle tibia, not half as long; correspondingly, the phallobase of the male of *L. tecta* is longer than in *L. usta*.

5. *Leptomastidea turba* Prinsloo, new species (Figs. 7, 19–21)

Description.—*Female*. Length: 0.8–1.1 mm. *Colour*: Head with frontovertex dark yellow, fading to white on lower face, temple and gena, fronto-occipital margin very narrowly darkened; setae silvery-white. Antenna with radicle blackish-brown; scape with dorsal aspect and upper sides blackish-brown, otherwise white; pedicel blackish-brown basally, apical half white; flagellum either entirely dark brown to blackish-brown or with funicle segments III and IV slightly to distinctly paler than remaining flagellar segments, this variation present in same sample of reared specimens. Thoracic dorsum and propodeum ranging from dark yellow to orange, pronotal collar white sides of propodeum behind spiracles blackish-brown; tegula largely whitish, only apex dark; mesonotal setation silvery-white; side of thorax whitish. Forewing (Fig. 7) with an oblique fuscous cross-band below submarginal vein, a second, broadly interrupted one below apex of venation and a



Figs. 19–24. *Leptomastidea* spp., female paratypes. 19–21. *L. turba*. 19, Apex of forewing venation. 20, Scutellum with sculpture enlarged. 21, Antenna. 22–24. *L. ascia*. 22, Apex of forewing venation. 23, Scutellum with sculpture enlarged. 24, Antenna.

large infuscated patch at anterior margin near apex of wing, setae below this infuscated patch darkened, but not wing membrane; hind wing hyaline. Legs whitish except middle and hind coxae, dorsal margins of femora usually, and tarsal tips,

brown to blackish-brown; gaster with basal half or so white, apical half blackish. *Head*: 1.9–2.1× as wide as frontovertex at median ocellus; lateral ocelli about twice own diameter from inner eye margins; eye a little more than twice as long as malar

space; sculpture much as described and illustrated for *L. usta*, diameter of cells on frontovertex about equal to that of eye facet; frontovertex from median ocellus to occipital margin with numerous scattered setae, remainder of front aspect of head sparsely setose; eyes finely and inconspicuously setose, setae shorter than diameter of eye facet. Antenna (Fig. 21) with scape 4.7–5.0× as long as broad; pedicel subequal in length to basal funicle segment; funicle segments subequal in length, basal one 3.0–3.5× as long as wide; club slightly longer than distal two funicle segments combined; funicle usually with linear sensillae on all except basal one or two segments, rarely present on all segments. *Thorax*: dimensions, sculpture and setation of mesonotum much as in *L. usta*, cells on anterior part of scutellum irregular in shape, as shown in Fig. 20. Forewing (Fig. 7) about 3× as long as wide; costal cell very narrow, indiscernible in some specimens; venation (Fig. 19) with postmarginal vein 1.3–1.4× as long as stigmal, about 3.5× length of marginal vein, latter 0.5× as long as stigmal; wing disc densely and evenly setose, arrangement of fine and coarse setae as illustrated. *Ovipositor*: almost 0.5× length of middle tibia, gonostyli 0.5× as long as middle tibial spur.

Male.—*Colour*: Differing from female mainly as follows: mesonotum not uniformly dark yellow but suffused with blackish-brown to a varying degree, gaster entirely blackish, its basal half not white; forewing with infuscation below apex of venation not forming a well defined interrupted cross-band, but appearing as two faint patches, one directly below venation, the other at posterior wing margin; disc beyond venation hyaline, without a subapical infuscated patch. Similar to male of *L. usta* in colour and structure, differing only in presence of a faint fuscous patch at posterior margin of forewing.

Variation.—At hand are several female specimens collected by sweeping from the same locality (Harare) in Zimbabwe.

These specimens have been excluded from the type material, from which they differ as follows: front aspect of head entirely yellow, not fading to white on face and gena; funicle segments III–V white in contrast to remaining flagellar segments, which are blackish-brown; side of thorax not entirely white, mesopleuron with dusky suffusions; legs with femora entirely pale, dorsal margins not outlined in blackish-brown; scutellum anteriorly with sculptural cells more regular in shape than shown in Fig. 20; forewing narrower, about 3.3× as long as wide.

These differences are here attributed to infraspecific variation, although further material, including reared series of both sexes, is required to determine the exact nature of the variation seemingly present in *L. turba*. This is especially important in view of the presence of a further specimen from Harare which, unlike the above-mentioned material from this locality, does not differ from the type specimens.

Type material examined.—Female holotype, 36 female, 13 male paratypes as follows: NAMIBIA: Otavi, ii.1978, C. Kok ex mealybugs (10 females, 1 male; T 7114); Chorixas, ii.1978, C. Kok ex mealybugs on *Welwitschia mirabilis* Hook. f. (3 females; T 6061). SOUTH AFRICA: Gauteng Province: Pretoria, iv.1995, O.C. Nesor, ex *Paracoccus burnerae* on *Senecio venosus* Harv. (holotype, 16 females, 11 males; T 7113); same data except xi.1988, S. Nesor (3 females, 1 male; T 6978). ZAMBIA: 15 KM e Lusaka, 11–19 and 20–31.ii.1980, R.A.Beaver (3 females; BMNH). ZIMBABWE: Harare, vii.1982, A. Watsham (1 female; BMNH). Holotype and paratypes in SANC unless otherwise noted.

Non-type material.—ZIMBABWE: Harare (= Rhodesia: Salisbury), vi.1978, i–iii and viii.1979, xi.1980, A. Watson, by sweeping (23 females; BMNH).

Remarks.—This widespread southern African species can be separated, in the female, from all other species of the genus by the maculation and setation of the fore-

wing. Structurally it is very similar to *L. usta*, from which it seems to differ only in the presence of linear sensillae on one or more of the basal three funicle segments. Apart from the difference in wing maculation, the female of *L. turba* also differs from *L. usta* in the colour of the head and thoracic dorsum which are paler, and the mesopleuron which is white, or white with dusky suffusions, not reddish.

6. *Leptomastidea ascia* Prinsloo, new species
(Figs. 8, 22–24)

Description.—*Female.* Length: 1.1–1.4 mm *Colour:* Frontovertex orange, fronto-occipital margin broadly suffused with blackish-brown, remainder of front aspect of head white with gena slightly darkened; setae on frontovertex and eyes dark. Antenna uniformly blackish-brown except ventral aspect and lower sides of scape, and apex of pedicel, white. Thorax and propodeum blackish-brown to almost black except: pronotal collar and prepectus white, tegula whitish basally, otherwise dark, mesopleuron entirely whitish, or with dusky suffusions; mesonotal setae silvery-white. Forewing with three fuscous cross-bands as in Fig. 8, basal one oblique, intermediate one (at apex of venation) at right angles to anterior wing margin, parallel-sided, broadly interrupted, the sub-apical band with two narrow interruptions; hind wing hyaline with a narrow oblique brownish cross-band near base. Fore coxa white, middle and hind coxae blackish-brown; legs otherwise usually sordid white with dorsal margins of all femora dark; in some specimens the femora, tibiae, and tarsi are more extensively darkened. Gaster entirely blackish-brown. *Head:* about twice as wide as frontovertex at median ocellus; lateral ocellus 1.5–2.0× its diameter from lateral eye margin; head with shape and sculpture otherwise much as illustrated for *L. usta*; frontovertex fairly densely and strongly setose; eye densely and strongly setose, se-

tae readily discernible under low magnification, each seta about as long as the diameter of eye facet. Antenna (Fig. 24) with scape just more than 6× as long as wide; pedicel subequal in length to basal funicle segment; funicle segments subequal in length, basal segment about 3.5× as long as wide; club as long as distal two funicle segments combined; funicle segments III–VI and club with linear sensillae. *Thorax:* shape of sculptural cells on anterior part of scutellum as in Fig. 23, more regular in shape than in the other species treated here. Forewing (Fig. 8) 2.7–2.8× as long as broad; costal cell relatively broad, clearly visible along its entire length with a single row of setae ventrally; venation (Fig. 22) with postmarginal vein 1.6× as long as stigmal, 3× as long as marginal, latter 0.5× as long as stigmal; setae (save those at base) confined to hyaline areas of disc finer and paler than those of infuscated areas. *Ovipositor:* 0.5× length of middle tibia; gonostyli 0.6× as long as middle tibial spur, latter subequal in length to basal tarsal segment of middle leg.

Male.—*Colour:* as in female except frontovertex more extensively suffused with blackish-brown, and infuscated areas on forewing paler, sub-apical cross-band indistinctly delineated. *Structure:* Differing from female mainly by slightly broader forewing, which is about 2.5× as long as broad, and antenna; antenna similar to that of male of *L. usta*, as shown in Fig 14; digiti of phallobase each terminating in two short, stout hooklets.

Material examined.—Female holotype, 55 female, 17 male paratypes as follows: KENYA: "Aberdare NP, 0.23S 36.46E, 10–18.ii.1999, T. Wagner, Canopy fog Podocarpus latifolius, BMNH 1999–279" (holotype, 27 females, 7 males); "Gatamayu, Kikuyu Esc. 2320m, 0.58S 36.42E, T. Wagner, ii.99, Canopy fog Podocarpus latifolius, BMNH (E) 1999–279" (26 females 7 males); "1600m, Mt Kenya NP (WHQ), 0.10S 37.10E, ii.1999, T. Wagner, Canopy fog Podocarpus latifolius, BMNH (E) 1999–279"

(2 females, 3 males). Holotype and paratypes in NMK; paratypes in BMNH and SANC.

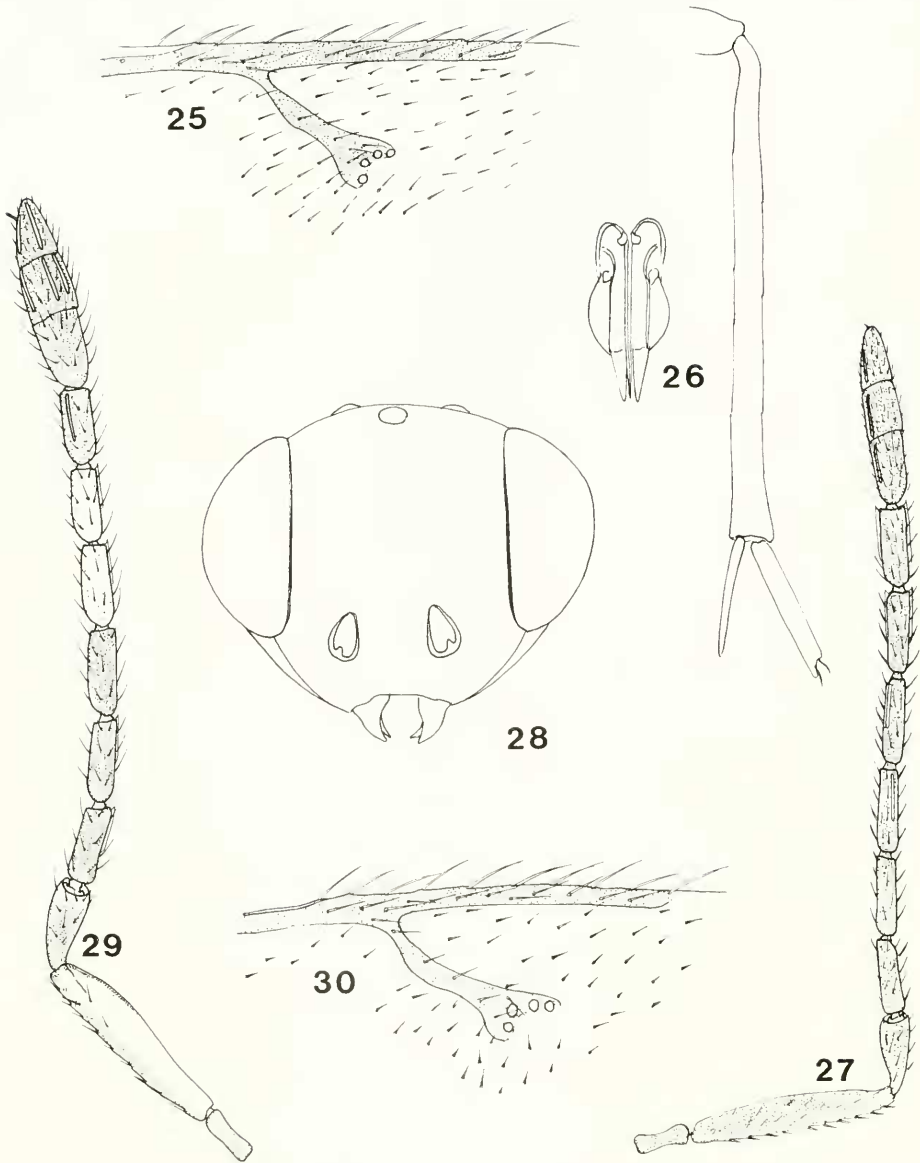
Remarks.—The three series on which this new species is based are all from central Kenya where they were collected (by fogging) on *Podocarpus latifolius* (Thunb.) R.Br. ex Mirb., a gymnosperm which is widespread in southern and East Africa. The mealybug host of this material is unknown, but may be *Eastia jouberti* De Lotto, the only species of mealybug known to be associated with this tree in sub-Saharan Africa.

Leptomastidea ascia appears to be most closely allied to *L. usta* and *L. turba* and, as in these two species, the cross-band at the apex of the fore wing venation is broadly interrupted. The wing pattern beyond the venation in these three species is, however, different. In addition, *L. ascia* is distinguished from *L. usta* and *L. turba* by its larger size, entirely blackish thoracic dorsum and abdomen, dark setae on frontovertex, densely pubescent eyes, and difference in the shape of the sculptural cells of the scutellum.

7. *Leptomastidea lamto* Prinsloo, new species
(Figs. 4, 26–27)

Description.—*Female.* Length: 0.7–1.1 mm. *Colour:* Head with frontovertex dark yellow from occipital margin to just above upper limits of scrobes, lower part of head white; setae on frontovertex dark. Antenna, save white apex of pedicel, either entirely dark brown or with scape white below along its entire length. Thoracic dorsum variable: more or less concolorous with frontovertex or with entire mesonotum, or axillae and scutellum only, with brown to blackish-brown suffusions; tegula whitish basally, apical half dark; propodeum largely blackish-brown; side of thorax with prepectus white, mesopleuron whitish, with darker suffusions in most specimens; mesonotal setae whitish. Forewing with an oblique dark cross-bands be-

low submarginal vein; disc from level of apex of venation fuscous with a large oblique hyaline area extending from anterior wing margin to near posterior margin, as shown in Fig. 4; in some specimens extreme apex of wing also hyaline; hind wing palely infuscated near base and along anterior margin beyond venation. Legs whitish except middle and hind coxae blackish-brown, dorsal margins of all femora, and hind tarsus, with brownish suffusions in some specimens. Gaster whitish with syntergum and apex blackish-brown. *Head:* 2.0–2.3× as wide as frontovertex at median ocellus; ocelli in an approximately right-angled triangle, lateral pair separated from inner eye margins by slightly more than own diameter; head with dimensions and sculpture otherwise much as illustrated for *L. usta*; eyes fairly densely but very finely setose, appearing naked under low magnification, setae about as long the diameter of eye facet; frontovertex from median ocellus to occipital margin with numerous long, dark setae extending along entire length of each inner eye margin in a single row; front aspect of head otherwise finely and sparsely setose. Antenna (Fig. 27) with scape about 5.7× as long as wide; pedicel ranging from slightly shorter to as long as basal funicle segment; funicle segments subequal in length, basal segment about 4× as long as broad; club as long as distal two funicle segments combined; linear sensillae present on club and funicle segments III–VI. *Thorax:* dimensions, sculpture and setation of mesonotum much as described and illustrated for *A. usta*. Forewing (Fig. 4) 2.7–3.3× as long as wide; costal cell very narrow, hardly discernible in some specimens; venation (Fig. 25) with postmarginal vein 1.5–2.0× long as stigmal, about 3.3× the length of the marginal vein; disc with setae confined to the large hyaline area beyond venation much finer, shorter and paler than setae on remainder of disc. *Ovipositor* (Fig. 26): one-third length of middle tibia; gonostyli 0.5 X



Figs. 25–30. *Leptomastidea* spp., female paratypes. 25–27. *L. lamto*. 25, Apex of forewing venation. 26, Ovipositor and middle tibia drawn to the same scale. 27, Antenna. 28–30. *L. pondo*. 28, Head, frontal view. 29, Antenna. 30, Apex of forewing venation.

length of middle tibial spur, latter slightly shorter than adjacent tarsal segment.

Male.—Unknown.

Material Examined.—Female holotype, 32 female paratypes as follows: CAMEROON: Nkoemvon, viii.1979, D. Jackson (1 female); Victoria Bot. Gardens, 6.xii.1981, Compton (1 female). GABON:

Forêt de la Mondah, 15–25 km N. Libreville, 25.xi–3.xii.87, J.S. Noyes (1 female); Forêt de Sibang, 5km E. Libreville, 30.xi–2.xii. 87, J.S. Noyes (1 female). IVORY COAST: Lamto, 6.13N 5.02W, xi.1988, J.S. Noyes (holotype, 14 females); Sassandra, 26.ii–1.iii.1984, M. Matthews (1 female); Gagnoa, Antonihio, 2–5.iii.1985, M. Mat-

thews (2 females). NIGERIA: Ibadan, Oyo St., IITA compound, xi.1987, J.S. Noyes (10 females). TOGO: 10 km NW Kapalimé, xii.1988, J.S. Noyes (1 female). Holotype and paratypes in BMNH; paratypes in SANC.

Remarks.—This species, which is evidently widespread in West Africa, is separated from its congeners by the distinct maculation of the forewing, in addition to a combination of characters which include the generally yellow to brown colour of the head and thorax, uniformly dark brown antennal flagellum, relatively narrow frontovertex and placement of the ocelli, slender funicle segments and short ovipositor, as described above.

8. *Leptomastidea pondo* Prinsloo, new species

(Figs. 1, 28–30)

Description.—*Female.* Length: 0.8–0.9 mm. *Colour:* Head with frontovertex from occipital margin to near upper limits of scrobes yellow, lower part of head white; setae on frontovertex silvery-white. Antenna with radicle brown; scape largely whitish, suffused with brown dorsally along its entire length, ventral margin darkened at apex; pedicel brown with apex whitish; funicle segments I–III brown, IV–V whitish, VI brown but slightly paler than basal three segments; club brown. Thoracic dorsum with pro- and mesonotum yellow, metanotum whitish; propodeum whitish with brownish suffusions posteriorly; tegula white save slightly darkened apex; thoracic setation silvery-white; side of thorax white. Forewing hyaline except for a pale oblique fuscous cross-band below submarginal vein and dark patch at apex of venation, as in Fig. 1. Legs white except middle coxa and tarsal tips dark brown. Gaster with basal two-thirds or so white, apical third dark brown. *Head:* (Fig. 28) 1.7× as wide as frontovertex at median ocellus; ocelli in a right-angled triangle, lateral pair separated from inner eye margins by about twice

their own diameter; head otherwise with sculpture and setation much as described and illustrated for *L. usta*. Antenna (Fig. 29) with scape 4.6× as long as wide; pedicel subequal in length to basal funicle segment; funicle segments subequal in length, segment 1 3× times as long as wide; club as long as distal two and a half funicle segments combined; club and all six funicle segments with linear sensillae. *Thorax:* dimensions, sculpture and setation of mesonotum much as in *L. usta*. Forewing (Fig. 1) 2.7–2.8× as long as wide; costal cell narrow in its basal one-third, not discernible in apical two-thirds; venation (Fig. 30) with postmarginal vein 1.6× length of stigmal, 3.3–3.5× as long as marginal, latter 0.5× as long as stigmal; wing disc fairly evenly and densely setose from base to apex, setation uniform throughout, not divided into areas of fine and coarse setae as in most other species of genus. *Ovipositor:* slightly distorted in single slide-mounted specimen, appearing about 0.5× length of middle tibia, gonostyli 0.5× as long as middle tibial spur, latter subequal in length to basal tarsal segment of middle leg.

Male.—*Colour:* Head and thorax much as in female; antenna with scape largely whitish, otherwise entirely dark brown; forewing patterned as in female; legs entirely whitish except dark tarsal tips, middle coxa very slightly embrowned; gaster entirely dark brown. *Structure:* Differing from female mainly in toruli which are placed higher on face, eyes which are slightly smaller and antennal shape: antenna with funicle segments subequal in size, tapering strongly at their apical ends, basal segment 5× times as long as broad; funicle clothed with whorls of long, curved setae, each seta approximately 5× as long as the width of a segment; club as long as distal two funicle segments combined with a longitudinal row of four spine-like setae near base. Phallobase one-third length of middle tibia in single slide-mounted paratype.

Material examined—Female holotype, 5 female, 3 male paratypes (SANC) as follows: SOUTH AFRICA: KwaZulu-Natal Province: Port Edward, i.1972, H.P. Insley, ex mealybugs on *Maytenus undata* (Thunb.) Blakelock (T 4166).

Remarks.—*Leptomastidea pondo*, which is known only from South Africa, differs in the female from other species of the genus by the forewing which is mostly hyaline except for the presence of a cross-band below submarginal vein and dark patch at apex of venation. It can be distinguished further from its Afrotropical congeners in the female by the generally pale yellow appearance, white hind coxa, broad frontovertex, and uniformly setose forewings.

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